SCIENCE.

FRIDAY, NOVEMBER 14, 1884.

COMMENT AND CRITICISM.

THE CUSTOM-HOUSE at Philadelphia and the Treasury department at Washington are wrestling over a difficulty growing out of the special tariff upon 'philosophical instruments.' Such instruments are, under the law of 1883, subject to a duty of thirty-five per cent, while instruments of glass or metal, not 'philosophical,' are subject to forty-five per cent duty. Where can the line be drawn? An astronomical telescope is evidently philosophical, as the word goes. But there are instruments of every grade, from the 26-inch equatorial to the little glass through which the opera-goer contemplates the movements of his favorite *prima donna:* shall they all be classed together? If not, who can define what telescopes, spyglasses, binoculars, lorgnettes, microscopes, and other instruments for aiding vision, are entitled to patents of nobility which shall distinguish them from the plebeian mass of 'manufactures not specially provided for in this act'? Of course the same question arises in the case of chemical and physical instruments of all sorts, which may be used either in a laboratory, private or public, in a factory or telegraph-office, or in a children's playroom. It is understood that the aid of the National academy of sciences will be invoked to furnish a solution of the problem, and the result will be looked for with great curiosity.

THE PROBLEM, how to make scientific assemblies more profitable to those who attend them, is constantly recurring. It is conceded that the more profound and special a paper may be, the fewer will be the number of those who take an interest in hearing it. On the other hand, if those who are special and profound are not to be encouraged to present their papers to scientific associations, who shall have the privilege? Certainly not the vague and the shallow. Papers must be presented, as elaborate and recondite as can be secured; but such papers repel the auditors. What shall be done in the dilemma? How can the mathematician presenting some new development of the theory of functions expect to interest the botanist? How can the petrographer discussing the microscopic aspects of rocks command the attention of the morphologist? Or, in a philological association, how can an elaborate paper on some point in the grammar of the Vedas command the attention of linguists who have never learned the Sanscrit alphabet? Has the advancement of knowledge reached such a point that there is no place left for the general society, the academy of science, and is specialization to be so special that each line of inquiry is to be considered only in a limited company of those who are devoted to it?

We venture to make a few suggestions which seem to us worth considering by those who are called upon to manage scientific meetings, especially the annual gatherings which bring from a great distance, at a great expense, those who are desirous of securing the utmost advantage from the meeting. *First*, Let the committee in charge make arrangements of a positive character for the conduct of the meeting, and require conformity to their regulations. Among these rules should be, (1) a strict adherence to the allotted time; (2) the presentation, in advance, of an abstract of what is to be read (and this should be printed, particularly if it contains any tabular statement, mathematical formulas, chemical formulas, or other rigidly technical statements); (3) the allowance of a definite time for discussion, questions, answers, and comments. *Second*, Let every speaker or reader form the habit of stating in general terms the purpose of his investigation, its relations to other work, and its results, refraining from going into minute details unless he is sure that a considerable part

of the audience can follow him. Let him always remember that there are some statements which the mind cannot readily receive through the portal of the ear; and there are but few which cannot be simultaneously presented, both to the eye and the ear. The diagram, the printed formula, the abstract, may cost the speaker a little expenditure; but it will save the hearer a vexatious outlay of time and attention. *Third*, Let there be a liberal margin allowed for social intercourse outside of the meetings, not merely for public receptions and excursions, but for those informal introductions and interviews which to many persons are the best part of scientific gatherings. We should not then hear it said so often, "This would have been a very pleasant meeting were it not for the papers which were read."

A REMARK made in one of the papers read before the recent Woman's congress in Baltimore suggests an interesting argument in favor of the kindergarten. It is well known, that, in its development, each new-born being passes through very much the same stages that his ancestors have been through before him. Even after birth, the growth of the child's intelligence simulates the progress of the human race from the savage condition to that of civilization. It has been shown by Preyer, and others who have studied infant-development, that a faculty which has been acquired by the race at a late stage is late in making its appearance in the child. Now, reading and writing are arts of comparatively recent achievement. Savage man could reap and sow and weave, and build houses, long before he could communicate his thoughts to a person at a distance by means of written speech. There is, then, reason to believe that a child's general intelligence would be best trained by making him skilful in many kinds of manual labor before beginning to torture him with letters; and the moral to be derived is, that primary instruction should be instruction in manual dexterity, and that reading and writing could be learned with pleasure and with ease by a child who had been fitted for taking them up by the right kind of preparation. The argument is a novel one, and it certainly seems plausible.

LETTERS TO THE EDITOR.

Change in the color of the eye.

IN *Science*, p. 367, you say the color of the iris, 'after early childhood' 'does not vary with age:' I think I can give you positive evidence that it does. My own eyes were called black (in reality dark brown) until after I was forty years old. About that time they commenced to change, and are now blue-gray, with streaks of light hazel, which last are fast fading out. The same thing happened with my father's eyes. I remember him at forty years and under, with thoroughly black eyes, and there are portraits of him which show him thus; but between forty and fifty, his eyes changed, and eventually became a blue, with a very slight tint of hazel, not noticeable without close observation. THEODORE F. MCCURDY.

Norwich Town, Conn.

The eggs of Ornithorhynchus.

The editorial comments in a recent number of *Science* (p. 412), on the revival of forgotten statements, lead me to believe that some more old matter may be revived with profit. The telegram sent to the meeting of the British association from Professor Liversedge, announcing the fact ascertained by Mr. W. H. Caldwell (*Science*, iv. 261), that Ornithorhynchus lays eggs, has been universally hailed as an entirely new discovery; and a number of the prominent British zoölogists, whom we had the pleasure of welcoming to Washington recently, were unaware that the oviparity of the monotreme had long before been definitely announced, and an egg figured. Nevertheless, such is the fact; and an extensive series of old comments and applications of the fact appears in the literature of zoölogy. I need only refer to some of the most prominent, and others can follow up the subject in the publications of the day.

In 1829 Geoffroy Saint-Hilaire published a memoir in the *Annales des sciences naturelles* (xviii. 157–164), in which he reproduced a *figure of an egg* of the natural size (pl. 3, fig. 4). This was communicated to him by Prof. Robert E. Grant of London, who drew one of a nest of four obtained by a Mr. Holmes. Two of these eggs were reported to have been obtained by the 'Muséum de Manchester;' and it would be well for our Manchester friends to hunt them up, and see whether they are still to be found. As a result of a general belief in the oviparity of the animal, several of the naturalists of the day revised the classification of the vertebrates.

In 1830 Dr. Joh. Wagler, in his 'Naturliches system der amphibien,' proposed a peculiar class (Gryphi—Greife), in which, however, by illegitimate assumptions, he included the ichthyosaurians, plesiosaurians, and pterodactyles.

In 1831 Charles L. Bonaparte, prince of Musignano, in his 'Saggio di una distribuzione metodica degli animali vertebrati,' also isolated the monotremes as a peculiar class (Monotrema), defining it in the following terms: "I Monotremi sono animali vertebrati, a sangue calido, *ovipari*, quadrupedi; respirano per mezzo di polmoni; hanno un cuore biloculare biaurito."

And even long before the egg was thus figured,

and, it may be said, the oviparity of the monotremes firmly established, the fact had been authoritatively proclaimed. Sir John Jamison, for instance, especially declared that 'the female is oviparous, and lives in burrows in the ground' (*Trans. Linn. soc. London*, xii. p. 585). The Rev. Dr. Fleming, in his 'Philosophy of zoölogy' (ii. 215), published in 1822, remarked, that, "if these animals are oviparous (and we can scarcely entertain a doubt on the subject, as *the eggs have been transmitted to London*), it would be interesting to know the manner of incubation." Further, Fleming refused to admit the monotremes among the mammals, dividing the Vertebrata 'with warm blood' into 'quadrupeds' and 'birds,' and the former into 'I. Mammalia' ('1. Placentaria' pedota and apoda, and '2. Marsupialia'), and 'II. Monotremata.'

But, notwithstanding all these facts, scepticism as to the truth of the representations and authenticity of the eggs, developed into positive disbelief; and Bonaparte himself recanted, and took that decidedly retrograde course, which others had entered upon, of associating the monotremes with the marsupials in the unnatural and artificial negative group of Ovovivipara, or Implacentalia. I, too, was so far influenced by the prevalent scepticism or disbelief, and by the similiarity of the monotreme egg to that of a reptile, that I retained viviparity as a special attribute of the mammals in 1872, although I declined, on other evidence, to include a small size for the eggs in my diagnosis of the class. I then, also, adopting the subclasses Monodelphia, Didelphia, and Ornithodelphia, segregated them into the major groups, combining the first two under the name Eutheria, and contrasting the last as the Prototheria. These names have since been accepted by Professors Huxley, Flower, and others; and, inasmuch as Professor Huxley did not accredit their origin, they have been ascribed to him. I must add, however, that Professor Huxley has restricted the name Eutheria, although apparently with a hypothetical qualification, to the monodelphs, while he has coined a new name (Metatheria) for the marsupials. I fail to appreciate the need for such modifications, which virtually become exact synonymes of Monodelphia or Placentalia, and Didelphia.

Finally, the old data as to the oviparity of monotremes became almost lost to memory, so that no one has recalled them since the rediscovery. In view of such forgetfulness and scepticism, therefore, further information was necessary to insure the admission of the old evidence as valid. But Mr. Caldwell has further added the intelligence, quite new, that the eggs of Ornithorhynchus are meroblastic. This discovery will have an important bearing on the question of the origin of the mammals, and is antagonistic to the suggestion of Professor Huxley that the type was a direct derivative from the amphibians, while it increases the possibility that Professor Cope may be nearer the truth in affiliating the ancestors of the mammals to the theriomorphous reptiles of the Permian.

THEO. GILL.

Sun-spots.

The long-delayed maximum of solar spots, now undoubtedly passed, has attracted unusual attention to the spot-periodicity. To-day and yesterday the visible hemisphere of the sun was, for the first time in nearly fourteen months, observed to be entirely free from spots; the occasion next preceding this being 1883, Sept. 25. During the past two years, the only additional days on which the sun was observed to be without spots were, in 1882, Oct. 9 and Dec. 3, and, in 1883, Feb. 23, and May 25, 26, 27, and 28.

DAVID P. TODD.

Lawrence observatory, Amherst, Mass., Nov. 8.

The numerical measure of the success of predictions.

Suppose we have a method by which questions of a certain kind, presenting two alternatives, can in every case be answered, though not always rightly. Suppose, further, that a large number of such answers have been tabulated in comparison with the events, so that we have given the following four numbers: —

(aa), the number of questions for which the answers were the first way and the events the first way;

(ab), the number of questions for which the answers were the first way and the events the second way;

(ba), the number of questions for which the answers were the second way and the events the first way;

(bb), the number of questions for which the answers were the second way and the events the second way.

Then the problem is, from these data to assign a numerical measure to the success or science of the method by which the answers have been produced. Mr. G. K. Gilbert (*Amer. meteorological journal*, September, 1884) has recently proposed a formula for this purpose; and I desire to offer another.

I make use of two principles. The first is, that any two methods are to be regarded as equal approximations to complete knowledge, which, in the long-run, would give the same values for (aa), (ab), (ba), and (bb). The second principle is, that if the answers had been obtained by selecting a determinate proportion of the questions by chance, to be answered by an infallible witness, while the rest were answered by an utterly ignorant person at random (using *yes* and *no* with determinate relative frequencies), then the approximation to knowledge in the answers so obtained would be measured by the fraction expressing the proportion of questions put to the infallible witness. The second witness may know *how often* he ought to answer 'yes;' but I give him no credit for that, because he is ignorant *when* he ought to answer 'yes.'

Let i be the proportion of questions put to the infallible witness, and let j be the proportion of questions which the ignorant witness answers in the first way. Then we have the following simple equations: —

$$(aa) = i\{(aa) + (ba)\} + (1-i)j\{(aa) + (ba)\},$$
$$(ab) = (1-i)j\{(ab) + (bb)\},$$
$$(ba) = (1-i)(1-j)\{(aa) + (ba)\},$$
$$(bb) = i\{(ab) + (bb)\} + (1-i)(1-j)\{(ab) + (bb)\}.$$

Now, whatever the method of predicting, these equations can always be satisfied by possible values of i and j, unless the answers are worse than if they had been taken at random. Consequently, in virtue of the two principles just enunciated, the value of i obtained by solving these equations is the measure of the science of the method. This value is,

$$\begin{aligned} i &= \frac{(aa)}{(aa)+(ba)} - \frac{(ab)}{(ab)+(bb)}, \\ &= \frac{(aa)}{(aa)+(ba)} + \frac{(bb)}{(ab)+(bb)} - 1, \\ &= \frac{(aa)(bb) - (ab)(ba)}{\{(aa)+(ba)\}\{(ab)+(bb)\}}. \end{aligned}$$

Mr. Gilbert's formula has the same numerator, but

a different denominator. It is, in the present notation,

$$i = 2\frac{(aa)(bb) - (ab)(ba)}{\left\{(aa) + (ab) + (ba) + (bb)\right\}^2 - (aa)^2 + (ab)^2 + (ba)^2 - (bb)^2}.$$

For Sergeant Finley's tornado-predictions, $(aa)=28$, $(ab)=72$, $(ba)=23$, $(bb)=2{,}680$. From these data, Mr. Gilbert finds $i = 0.216$, while my formula gives $i = 0.523$.

If the questions should present more than two alternatives, it would be necessary to assign relative values or measures to the different kinds of mistakes that might be made. I have a solution for this case.

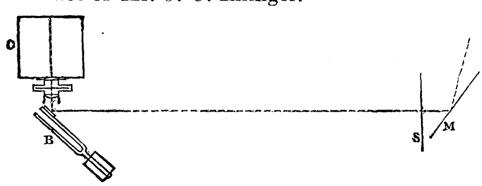
Another problem is to measure the utility of the method of prediction. For this purpose, let p be the profit, or saving, from predicting a tornado, and let l be the loss from every unfulfilled prediction of a tornado (outlay in preparing for it, etc.); then the average profit per prediction would be,

$$\frac{p\,.\,(aa) - l\,(ab)}{(aa) + (ab) + (ba) + (bb)}.$$

C. S. Peirce.

Measurement of the speed of photographic drop-shutters.

The usual method adopted for this purpose depends on photographing a white clock-hand revolving rapidly in front of a black face.[1] The chief difficulty in this case is to maintain a uniform rotation at high speed. To avoid this difficulty, and to determine the uniformity of exposure of any particular shutter under apparently like circumstances, the following method has been suggested. In carrying out the experiment in practice, I have had the assistance of Mr. J. O. Ellinger.



A tuning-fork, B, with a mirror attached to the side of one of the prongs, is placed in front of the camera-lens. This mirror is so arranged as to reflect into the camera, C, a horizontal beam of sunlight, which, before reaching the fork, has passed through a half-inch hole in a screen, S, placed about ten feet distant. This produces on the ground-glass a minute brilliant point of light. If the fork be set vibrating, the point will become a short, fine, horizontal line: if the fork be rotated about its longitudinal axis, the line will become a sinusoidal curve described on the circumference of a circle of long radius. A photographic plate is now inserted, and the drop-shutter attached. On releasing the latter, it will be found that a portion of the sinusoid has been photographed; and the precise exposure may be determined by counting the number of vibrations represented on the plate.

The mirror employed should be somewhat larger than the lens to be measured, so as to cover its edges during the whole exposure. The mirror may be glued directly to the prong of the fork with strong carpenter's glue, after first scraping off a little of the silvering at the edges of the glass. The rate of the fork is then determined, by comparison with a standard fork, by the method of beats. W. H. Pickering.

Photographic laboratory,
Mass. inst. of technology.

[1] For other methods, see *Brit. journ. photography*, Aug. 31, 1883, and May 23, 1884.

THE IMPORTANCE OF CHEMISTRY IN BIOLOGY AND MEDICINE.

The position of chemistry in the biological sciences has long been, in English-speaking communities, a very indefinite one: in fact, it may be questioned whether the science has, even at the present day, any generally recognized position among biologists themselves. That this has been the case for many years, even in Europe, is evident from the fact that until recently the published results of investigation in the field of physiological chemistry have had to be sought for in widely diverse places. Many papers have been published in purely chemical journals, others in journals devoted to physiology, while still others have appeared in so-called 'natural-history' journals, — a fact which in itself plainly indicates the past status of this branch of science.

There can be no question that physiological chemistry should occupy a definite place among the biological sciences. Biology is confessedly a study of life, and, as such, has to do with the development, structure, and function of living organisms. The first two of these we suppose to be included under the heads of embryology and morphology; while the third, constituting, in the words of Herbert Spencer, "the second main division of biology, embracing the functional phenomena of organisms, is that which is in part signified by physiology." Further, "that part of physiology which is concerned with the molecular changes going on in organisms is known as organic chemistry," or, with equal propriety, as physiological chemistry: hence a study of the functions of the body, to be at all complete, must include a study of the chemical changes incident to life, and cannot be restricted to the purely physical phenomena of the organism. Yet it is very noticeable that wherever 'biology' is taught in this country, even in the most liberally conducted institutions, where the course of study embraces embryology, animal and vegetable morphology, experimental physiology, etc., physiological chemistry is rarely mentioned.

We need to inquire whether this is due to a

lack of appreciation of the importance of the subject, or whether it is generally considered as outside the pale of biological inquiries. We are more inclined to believe that the rapid development of the past twenty years in the various branches of biology, so divergent from chemistry, has tended to push into the background the chemical phenomena of life to such an extent that the existence of chemical science as a part of biology is in danger of being forgotten.

Physiology in its entirety, dealing with all the functions of the living organism, both animal and vegetable, is truly a broad subject; but that by itself does not constitute a sufficient reason why the chemical composition and chemical processes of the organism should be so seldom studied. By this it is not meant that all applications of chemistry to physiology are overlooked, or that there is an utter lack of appreciation of its importance, but rather that the average instruction in physiology in this country, and apparently likewise in England, disregards almost every thing pertaining to chemistry, aside from the common fundamental facts; so that, whether as a part of physiology, or as physiological chemistry, the average student in biology acquires but little knowledge of the chemical processes of the animal organism; by 'knowledge' being meant that personal knowledge, which, in the case of an experimental science, can be obtained only in a properly equipped laboratory.

But while in America little has been done either to advance or to teach the chemical side of physiology, in Europe it has been very different, until now as a growing science, following a natural law of progressive division of labor and of thought, the chemical phenomena of the living body have massed themselves together, and, aided by increased interest and added workers, a division of physiology has become necessary; and to-day there exists, in Germany at least, a new science, or rather a specialized portion of an old one, viz., that of physiological chemistry.

We would lay all possible stress on the important position of physiological chemistry in Germany, its relation to medicine and biology in general, the large number of important researches emanating from her laboratories, and on all that tends to make the science so progressive in that country; and then, by contrast, how small and insignificant appears the little work done in our own country! If we look to the biological laboratories of our colleges, to our medical schools, and to the laboratories connected with our hospitals, we find an almost utter lack of work tended to increase the boundaries of the science. Seldom do we hear of a piece of original work in physiological chemistry; and few American names are being added to that long list of German investigators whose united work has made the science what it is to-day.

There is also a practical side to this question. Not every medical student, it is true, can become proficient in physiological chemistry, there is not time for it; but many a man gifted with powers of observation, and endowed with a love of knowledge, may find much to do of direct practical value to medical science. Every student of medicine should, however, possess some knowledge of physiological chemistry. Dr. Perkin, in his recent address before the Chemical society of England at its anniversary meeting, says, "If there is any value in chemical products as curative agents, if there is any value in physiological chemistry, or any importance in toxicology, surely medical students should have a sound knowledge of chemical science, and not simply learn to detect an acid and a base in a mixture, — an operation which is of no value, except as an intermediate exercise to be followed by more advanced work."

What is needed in this country is a fuller appreciation of the importance of physiological chemistry, both in biology and in the science of medicine. A host of questions are to be answered regarding digestion, nutrition, respiration, etc., — questions to be answered only through the agency of chemical science; and, if America is to do her share in the clearing-up of the mysteries surrounding the chemical processes of the living organism, physiological

chemistry must be raised to a higher plane among the biological sciences.

THE NAVIGATION OF THE NILE.

THE Nile, which during thousands of years has attracted much attention from the intelligent portion of mankind, yet remains in many respects the most interesting of the great rivers of the globe. Its sources, which for so long a time were a mystery, have within the last quarter of a century been rediscovered; but that rediscovery has only rendered it more interesting, and more worthy of study.

The great fluctuations in its flow, and the remarkable, almost mathematical, regularity, year after year, of these fluctuations, can now be practically studied, and their causes clearly understood.

Having its great first reservoir under the equator, we now know that it derives its waters from the region between a few degrees south of that line, and latitude about 13° north. It receives its last affluent, the Atbara, south of latitude 13° north, and yet continues its flow, notwithstanding evaporation, receiving nothing, and giving life to the lands it traverses, until it pours the waters of south central Africa into the Mediterranean Sea, in latitude 32° north, carrying in those waters, each year, masses of the *débris* of the mountains of the interior to continually fertilize and extend its delta.

Early in June of each year the flow is the least. The current near Cairo has then a rapidity of only a little more than one mile per hour, and the amount of water passing is only from four hundred to five hundred cubic yards per second. Before the end of June the annual rise commences; and by the end of September the rapidity of the current reaches nearly, if not quite, three and a half miles per hour, the quantity of water passing a given point becoming from *nine thousand* to *ten thousand* cubic yards per second.

Late in October, or early in November, it commences a somewhat rapid decline, which continues until January, when the decline becomes more gradual and regular; this gradual decline continuing until about the end of May, when the minimum flow is again reached, to give place the following month to the new annual rise.

The great regularity of the fluctuations is due to the peculiar sources of supply, and the admirable system of reservoirs and checks which nature has there provided.

The Egyptian Nile is formed by the junction, at Khartum, of the Blue Nile and White Nile.

The Blue Nile (*Bahr-el-Azrack*), taking its rise in the centre of Abyssinia, and fed by the rains which yearly fall in the mountains of that country during the months of April, May, June, July, and August, furnishes the great masses of water which cause the rapid summer rise, and also furnishes the rich silt, which, torn from the mountains of Abyssinia, spreads over the cultivatable lands of Egypt, and yearly renews the fertility of those lands.

The White Nile (*Bahr-el-Abiad*), flowing from the great reservoir under the equator, guarded in that and the subordinate reservoirs, Lake Ibrahim and Lake Albert, and guarded also by the great system of dams called 'the cataracts,' furnishes the steady flow of clear water which continues throughout the year.

No human engineer has ever devised, on any thing like so grand a scale, so admirable a system for the collection, preservation, and distribution of irrigating waters, as has there been formed by nature for the supply of Egypt.

Lake Victoria, with a surface of some forty thousand square miles, collects and stores, for the use of the Sudan and Egypt, the rain-water falling on a basin of more than a hundred and sixty thousand square miles of surface. The average yearly rise of the lake may be fairly taken, according to observations made on the spot, as two feet, which gives for distribution through its only outlet, the Victoria Nile (the Somerset of Speke), the enormous volume of more than sixty-eight thousand million cubic yards of water per annum, or more than two thousand cubic yards per second.

It will be seen that this storage is so well devised, that, in order to give *one inch* of rise to the Victoria Nile, more than *twenty-eight hundred millions* of cubic yards must be stored in this great reservoir.

Then come the two secondary reservoirs, — first Lake Ibrahim (discovered by Col. Long in 1874), in latitude north $1\frac{1}{2}°$, which must be filled before the flow can continue on towards Egypt; and then Lake Albert, which must be filled over its surface of perhaps three thousand square miles before the direct distribution of waters through the White Nile can fairly commence. But this is not all that nature has there done to regularize the great distribution. Between Lakes Ibrahim and Albert, there is a great system of natural dams in the cataracts which are found between Foweira and Lake Albert. Then coming north, down the White Nile, we find, first at Duffli, and soon again at Beddin, successions of rapids, the results

of other natural dams; and these we find repeated between Khartum and Berber, below Abu-Hamed, between that and Dongola, and between Dongola and Wadi-Halfa. At the last-named place is found what is called the second cataract; and still farther down the course of the river, at Assuan, is the well-known 'first cataract.' Thence to the sea the course of the great river is unobstructed in its flow, except by the works of man. The great viceroy, Mehemet-Ali, caused, at immense cost, the construction of the famous *barrage du Nil* ('the dam of the Nile') a few miles to the north of Cairo, in the endeavor to make art complete, by a dam, what nature had so well done in Central Africa and Nubia for securing regular irrigating-supplies.

The cataracts which play so important a part in the preservation and regulation of the Nile flow, are formed by masses of granite rock, which at intervals cross the course of the stream, making enduring dams. It is easy to perceive, that, should they be worn away or destroyed, the flow of the river would be made much more rapid during the seasons of high water; and the Nile would become, in Nubia, a fierce torrent during high water, and a nearly dry channel for a considerable portion of the year.

The natural destruction of these great dams by the formation of pot-holes, and the friction of *débris* passing over them, is, from the nature of the rock, very slow. From such observations as have been made, it is probable that the natural wearing-away hardly exceeds six feet in one thousand years; and there is a corresponding effect in the natural rising of the river-bed below the cataracts and in the delta by the deposit of silt from the turbid waters.

The Nile is navigable at all seasons of the year, by steamboats of light draught, from the mouth to Assuan (the first cataract), between the first and second cataracts (Assuan to Wadi-Halfa), between near Berber and Khartum, between Khartum and a point a little to the south of Gondokoro, and between Duffli and Lake Albert. It is only during the season of high water that boats can descend the Nile, passing the cataracts between Berber and Assuan.

The great danger to boats descending these fierce rapids during high water is found in the eddies near the river-banks, islands, and large rocks. The current is so rapid, and the friction on either hand so great, that the water seems to *heap up* in mid-channel, where the current is the strongest; and great skill on the part of the steersman, and prompt and vigorous work on the part of the engineer of the steamer, or oarsmen of a row-boat, are necessary to keep the boat on the ridge of the current. If the boat is permitted to slide off this ridge, she is quickly caught by the eddies, and almost invariably lost. This is so well understood by the Nubian boatmen, that, while they work with a will at the oars in these descents, they always have their personal effects packed in a snug parcel beside them, ready to seize; and they leap overboard, each with his parcel on his head, the moment the boat gets into a hopeless position.

The work of towing or warping boats up against the current is more difficult, but far less dangerous, than the descent.

CHAS. P. STONE.

A MUSSULMAN PROPAGANDA.

THE attention of geographers has of late been particularly attracted by the operations of a Mussulman confraternity known as the Sénousians, or the Brotherhood of Sidi Mohammed Ben Ali es-Senousi, the founder of the order. Of this now powerful and widely ramifying society, Henri Duveyrier has recently given an account. Its operations are of importance to civilization, not merely from the relation of this order to existing religions, but from that which it bears to the efforts being made by civilized nations to develop the dark continent, and explore its geographical and other mysteries. The success of the religious propaganda which the society represents menaces not only projected explorations, but the very existence of established colonies and international traffic. It is believed that to their instigation is due the melancholy fate of many African explorers of late years, among whom may be mentioned Dournous Dupéré, Beurmann, Von der Decken and his party, Col. Flatters, Capts. Masson and Diarnous, Dr. Guiard, Béringer, Roche, Mademoiselle Tinné, Sacconi, and others. If the present crusade in the Sudan be not wholly due to their machinations, it has at least been actively assisted and impelled by individual members of the society, and guided by the blind fanaticism which is its rule of conduct. The favorite motto of the head of the order declares Turks and Christians to be equally offensive, and doomed to an equal and simultaneous destruction. Their monasteries and influence extend from Morocco to Arabia, and from the Mediterranean to Mozambique, and govern two or three millions of peo-

ple. Under their teachings, peaceable blacks, who formerly welcomed trade and civilization, or did not oppose it, have become ferocious bigots; and large areas have thus been utterly closed to intercourse with the whites, unless accompanied by an army. A brief summary of the history and tenets of the fraternity will not be valueless.

Of the religious societies which have flourished in the bosom of Islam, the present is one of the latest, but, during the forty-seven years of its existence, has attained a far greater success than any of its predecessors.

Its founder was of the tribe of Medjaher, from the vicinity of Mostaghanem in Algeria, born during the last phases of the Turkish occupation, of which he was the declared adversary. Exiled to Morocco, he was initiated through the fraternity of Mulei Taiëb into the mystic philosophy known to orientalists as Chadheliya, or Chadhelism. He returned to his native land about the time that Algiers was taken by the French. He travelled as a teacher of law and philosophy through the highlands of Algeria, gradually making his way eastward toward the holy places of Arabia, attracted by the renown of the theologians gathered there, and especially of Ahmed Ben Edris, the patriarch of Chadhelism at Mecca. This philosophy was already tinctured with Wahabi radicalism; and in the course of his travels, stopping to give courses of instruction, and expound his views in various cities, he became equally obnoxious to the representatives of the established doctrines, and to the government of Egypt. Arrived at Mecca, he became first the pupil, then the successor, of the sheikh Ahmed Ben Edris. His first attempt to make converts in Yemen, on a journey with that end in view, was unsuccessful. He returned to Mecca, and addressed himself more particularly to the Berber pilgrims, to whom he taught what he called the 'way of Mohammed,'—a title afterward altered to the 'way of es-Senousi.' By this he intended a sort of reformed Chadhelism, partly drawn from the Korán and its commentators, and partly from his own meditations, which he presented to his pupils as the pure faith of Islam, disembarrassed of the theological incrustations of twelve centuries of theologians. This religion was distinguished from the first by its claims to absolute authority; and the writings in which his views are summarized bear the pretentious title of 'The rising suns.' His resolution of forming a religious order bore fruit about 1837. The object of the fraternity was to teach the following doctrines, among others: the exaltation of God, to whom worship is alone reserved; living saints may be venerated as permeated with the spirit of God, but this ceases with their death; their tombs must not be the goal of pilgrimage, nor their names used as intermediaries in prayer (even Mohammed forms no exception); the novice renounces the world, he will respect the authority of the caliph so long as the latter respects the society; political ambition must not be exercised against a true believer, but becomes a duty and a merit as against one who does not accept the true way, that is, the 'way of es-Senousi.'

Luxury and ornament are prohibited. Gold is reserved for the sword to be drawn in a holy war. Women, however, are excepted from these rules. Drunkenness, tobacco, and coffee are prohibited; tea allowed, if sweetened with brown sugar, the white sugar being impure, as refined by the use of bones of animals killed by unbelievers. It is forbidden to serve or to speak to a Christian or a Jew, or even to bow to them. Unless they are tributaries or slaves of believers, they are to be considered as outlawed enemies, to be robbed or killed at the most convenient opportunity. The society is allowed to fraternize with other Chadhelistic orders, — a condition of great importance, and to which much of its success is due. Almost all the Mussulman orders which at first repudiated the new doctrine have come to acknowledge its supremacy, and to conform to its policy.

The fraternity maintains itself in mystery. The acolytes wear no distinguishing dress or mark, their rosaries are similar to those commonly in use, and the supplementary prayer which they add to the usual matin is communicated only to members of the order.

The society holds convocations, prescribes pilgrimages to its monasteries, levies a tax of two and a half per cent on the capital of its followers for the treasury of the order. Those too poor to contribute money or stock render service as laborers, artisans, emissaries, spies, or even assassins. All means are held good toward their desired end, even the arts of light women being employed in cases where ruder influences have been repulsed. The order administers justice to its followers and those under its influence. For instance: in the Ottoman vilayet of Ben-Ghazi, in Barca, the authorities have even gone so far as to depute the administration of justice to the order. In all north-eastern Africa except Egypt the Mussulman swears by 'the truth of Sidi es-Senousi,' as formerly by that of Mohammed. Mild when weak, the order becomes defiant

with secure establishment, and even dared, in 1861, to excommunicate the sultan, Abd el-Mejid, for failing to respect its pretensions.

The operations of the order are carried on by a system of graded officers, priests, and missionaries, which, as well as their adroit and varied methods, strongly recall the marvellous organization once attributed to the order of Jesuits. Nor has the result been less successful. Tribes alien and unreceptive, rulers cold or jealous, populations indifferent or contemptuous, have been won over and firmly attached to the order. The hard-worked native transfers his field to the society, preferring to lay up treasures in heaven. The fraternity digs wells in the desert, revives withered oases, protects its votaries from the nomad thieves of the Sahara, buys, instructs, and frees slaves, and sends them to their distant homes as missionaries, with astonishing results.

The headquarters of the order are at the zaouia, or convent, of Jarabub, founded in 1861, on the 30th parallel, near the western frontier of Egypt. Its population has increased marvellously during the last ten years. The place was originally a desert. The society built reservoirs, began plantations, erected convents; and in 1880 the body-guard of the head of the order was estimated to consist of four thousand men and about two thousand slaves. The metropolitan is the son of Sidi es-Senousi, whose genius he would appear to inherit, and is known as Sidi Mohammed el-Mahdi, having, like the false prophet of the Sudan, assumed, at his father's instigation, the title equivalent to a Moslem messiah. The convent has become an arsenal, possessing large stores of arms and ammunition, and even fifteen cannon purchased at Alexandria. Aid and comfort are lavishly extended to those who have from time to time revolted against France in Algeria.

Too wise to inaugurate as yet the holy war predicted of El-Mahdi, the head of the order has, nevertheless, provided against external aggression. Suspecting that its propaganda may eventually rouse the arms of civilization against it, it is said that there are constantly kept at the zaouia of Aziat in Cyrenaica, for example, five hundred camels with their harness and equipments, drivers, etc., ready at a moment's notice to convey to the interior the persons and property of the Senousian authorities. The fraternity possesses one of the best ports in North Africa, — Tobrug, — where an illegitimate trade flourishes, and does not want for manufactories of powder.

France is, so far, the only civilized nation which has suffered directly from the policy of the order. In Algeria most of the rebellions of late years are attributed to the new propaganda. The insurrections there have been imitated in the French district of Senegal. We have already referred to the probable connection of the order with recent events in the Sudan.

We have refrained from entering into a multitude of details which support the preceding conclusions, and it is not necessary to recount the different tribes and petty African states which have gradually become converts to the views of the fraternity. Enough has been said, however, to indicate the unsuspected importance of this new factor in the politics of Africa. The blood of many explorers and travellers bears testimony to the violence of its fanaticism; and neither the geographer nor the anthropologist can regard with indifference a movement which falls little short of that which originally propagated the faith of Islam.

W. H. DALL.

THE RUBY-HILL MINES, EUREKA, NEV.

MR. J. S. CURTIS, whose report on the silver-lead deposits of Eureka, Nev., is now in press, has prepared for exhibition at the New-Orleans exposition, by the U. S. geological survey, a model of the Ruby-hill mines, from which the largest portion of the metals extracted in the Eureka district has been taken. This model is eighteen inches in height, and about four feet long by eighteen inches wide. It is composed of glass plates horizontally arranged at distances of one inch apart, each inch representing a hundred feet, and the glass plate showing a section at each mine-level in the body of the model, the mine-levels being that distance apart. The upper plates, however, are closer together, and are cut to show the contours of the surface at distances of fifty feet apart.

On these plates the geological formations, three in number (quartzite, limestone, and shale), all of the Cambrian period, are colored with transparent colors. The ore-bodies, occurring only in the limestone and of tertiary or pre-tertiary age, are very irregular in form, and are shown by opaque red paint; while the mine-workings, shafts, tunnels, etc., are represented in opaque black paint. The effect of the model is as though a skeleton of the mine-workings and ore-bodies were seen suspended in a solid glass mass, the coloring of the geological structure not interfering with the view, on account of its transparency.

The dominant factor of the structure of Ruby Hill is an extensive fault, which has determined the present relations of the formations. The presence of this fault is marked by a fissure filled in places with rhyolite. This fissure also forms the hanging-wall of the ore-zone. Above the water-level the ore is prin-

cipally galena, anglesite, mimetite, and wulfenite, with very little quartz and calcite, the gangue being for the most part hydrated oxide of iron. It also carries gold and silver, and zinc is present probably as a silicate. Below the water-level it is composed chiefly of pyrite, arsenopyrite, galena, blende, and a few other sulphides, besides silver and gold.

The ore-deposits are confined to a mass of crushed limestone between the main fault and the quartzite. Those of any size are always capped by caves, or in some way connected with them and with fissures. The caves were probably formed subsequent to the deposition of the ore, being due, partly to the action of water carrying carbonic acid, and partly to shrinkage of the ore from decomposition. Since the latter occurred, the ore has in many instances been redistributed by the flow of underground waters, whose former presence is indicated by stratification of portions of the ore-bodies, and by traces of aqueous agencies in the surrounding limestone.

The constituents of the ore were probably derived by solution from some massive rock, not sedimentary, as assays of the country rock show that they could not have been so derived. The solutions were due to solfataric action, incident to the eruption of large masses of rhyolite. They entered the limestone from below, through fissures; and the greater part, at least, of the ore, was deposited by direct substitution for that rock. The limestone was fissured and crushed in many directions by the various faulting movements, and gave free ingress to the ore-bearing solutions, which naturally followed the channels of least resistance, and deposited the ore in masses of very irregular form. These are well shown in the model.

From the year 1869 up to the present time (1884) the Eureka district has produced about sixty million dollars of gold and silver, and about two hundred and twenty-five thousand tons of lead: and, as already stated, the largest portion of these metals was derived from the Ruby-hill mines.

TWO LARGE SUN-SPOTS.[1]

THE figures of sun-spots given with this article are from drawings made at the observatory at Palermo, and represent two of the largest spots observed during the last two years, so remarkable for the number of spots seen. Not only was their extent (which is readily appreciated by comparison with the figure of the earth given on each plate) immense, but the changes which were seen to take place were most rapid.

The first appeared on the eastern limb of the sun on June 25, 1883, about at latitude +7° 55′. After undergoing various transformations, it offered, on the 30th of June, the curious aspect shown in fig. 1. The spot was double; and its extreme length from east to west was not less than ten earth diameters, or about 3′. Considerable movements were agitating it. Two days afterward, on the 2d of July, the two parts had separated, and between them the photosphere shone with marked whiteness. From day to day this separation increased, until the 8th, when the spots disappeared on the western limb, after a deviation toward the north of 2° 30′. From the 28th of June to the 2d of July, long, brilliant tongues, ending in

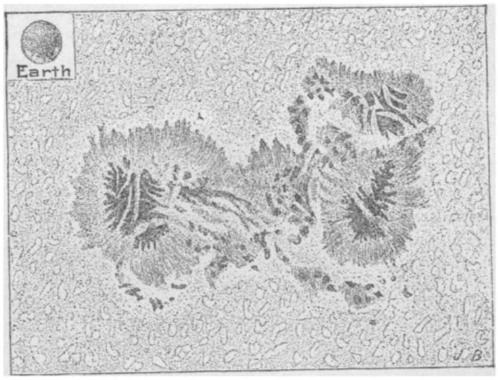


FIG. 1.

red hydrogen flames, were seen extending into the umbra; and a yellow coloring was observed on the penumbra and on some of the tongues, perhaps due to the presence of sodium (fig. 2).

This large spot was preceded and followed, on the limbs of the sun, by small but brilliant solar protuberances. It returned July 2, at latitude 8° 11′, much smaller and more regularly shaped, to make once more the tour across the disk of the sun, and disappeared at latitude +8° 23′, not to be seen again.

The second spot (figs. 3 and 4) was first seen on the

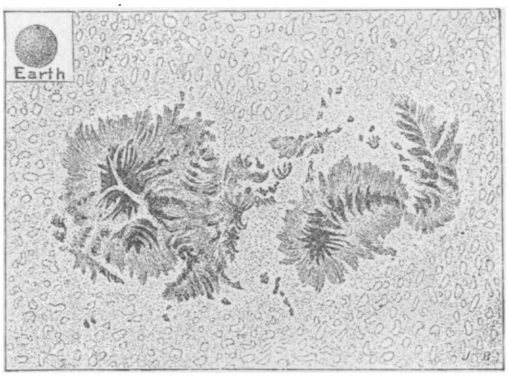


FIG. 2.

eastern limb, on the 10th of July, in latitude −7° 40′. It offered a strange appearance, and appeared to be the seat of much disturbance. On the 25th the centre was covered with luminous points which were in constant motion; and some strange lines of light seemed to be suspended over the umbra. The diam-

[1] Reproduced, with the cuts, from *L'Astronomie*.

eter of the spot itself was six times that of the earth, about 1′ 46″; but the portion of the sun's surface which was affected was much larger. By the 27th the secondary spots (fig. 4) which accompanied it had become much less conspicuous, while the

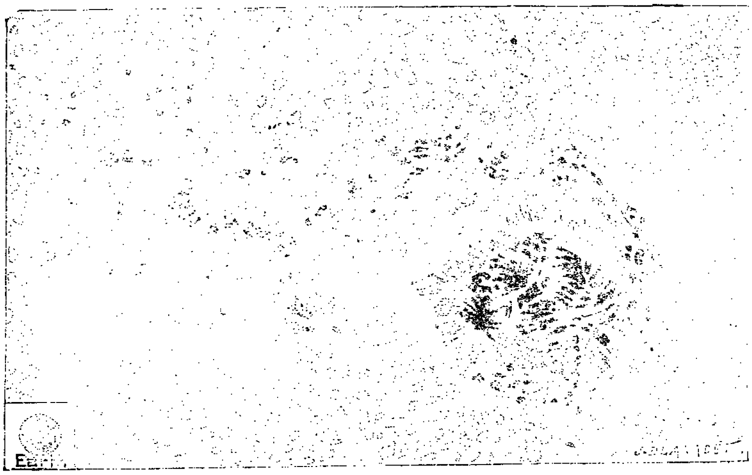


FIG. 3.

spot itself was the more marked, and curved tongues above it indicated great activity. From that day the spot began to diminish, and become more regular. On the 1st of August it reached the west limb, in latitude −11° 13′, having consequently moved 3° 33′ toward the south. The appearance of this spot was heralded on the eastern limb by small, very brilliant chromospheric flames; and its disappearance was followed by small but brilliant protuberances, and by the reversal of the coronal ray 1474^k. It returned on the east at latitude −10° 15′, but only as a couple of small dots, which vanished on the 21st.

It is worthy of remark, that these two large spots were formed almost at the ends of the same solar diameter, and that each showed a motion towards the pole of its respective hemisphere.

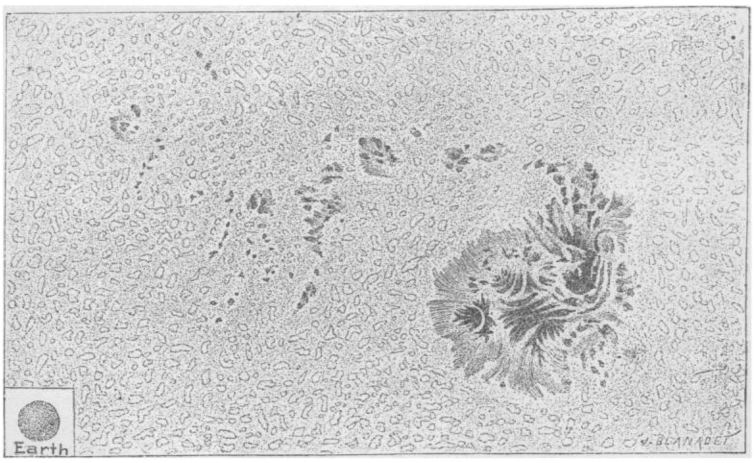


FIG. 4.

NEW VOLUME OF THE TENTH CENSUS.

THE eighth volume of the census of 1880, just issued from the government press, a bulky quarto of about twelve hundred pages and many plates and maps, is a curious medley, discussing as it does such diverse subjects as the newspaper and periodical press, the resources and sealeries of Alaska, and our ship-building industry. The appearance of these monographs under one cover is clearly a matter of convenience of distribution only.

The first portion, dealing as it does only with the political and literary press, hardly needs our special attention.

The report on the population, industries, and resources of Alaska, by Ivan Petroff, occupies a hundred and seventy-seven pages, while that on the seal-fisheries and collateral topics, by Henry W. Elliott, covers an equal number, not including indices.

As must always happen when reports of a frontier region remain unpublished for four or five years, the picture presented by them is chiefly useful for comparison with preceding or subsequent reports of the same kind. That there should, at the time of publication, be a considerable gap between the state of things as presented in the report, and their actual state, is inevitable; but perhaps in none of the census reports is

the difference more marked than in the one we are considering. The region of Alaska most populous, and most likely to afford room for settlement, and resources for development, as well as the most interesting ethnological features, was not visited by Mr. Petroff, who derives his statistics of south-eastern and western Alaska at second or third hand, or by compilation from already published works.

The fact that Mr. Petroff is of Russian extraction, had had several years' experience in Alaska as a private in the U. S. army and as a petty trader at the head of Cook's Inlet, and had translated several Russian works for Mr. H. H. Bancroft's library, gave a warrant for believing that he possessed special qualifications for the work assigned to him. Had the material gathered by him been subjected to a thorough sifting by an impartial statistician, the result would have been more valuable and much more reliable. At present, while the report contains much that is useful, and a great accumulation of facts, with some welcome translations from historical Russian works, it suffers, as a work of reference, from the attempt of the author to cover the faunal distribution of fur animals, history, philology, politics, geography, vulcanism, ethnology, and resources, — a task for which, with all due recognition of Mr. Petroff's merits, it cannot be said that he was qualified, and which has consequently been performed in an often inadequate way.

The report is illustrated by some extremely poor chromolithographic pictures of scenery and natives, which is the more to be regretted, as good photographs exist of most of the different Alaskan races which might easily have been utilized. There is a topographical and ethnological map of large size, and six smaller maps showing distribution of fur animals and forests, and the geographical divisions adopted. The plan is excellent; but the information is much more scanty than would be inferred from the maps, which, in minor details, are not in accord, in some cases, even with what information we have.

The topographical map has already been superseded by better ones in its groundwork, while the topography is necessarily mostly a matter of inference and assumption. This inheres in the nature of the case; but it may be questioned, whether, under the circumstances, such an ostentation of detail was desirable. Sundry old and some new errors have been introduced into it, the most striking of which is the erroneous position of the Yukon between the meridians of 140° and 145°. It is to be presumed that the information upon which this was based was derived from the traders, who desired to locate the (now abandoned) trading-post of Fort Reliance on the American side of the line, to avoid international questions. The earlier map of the telegraph explorers, and the later running survey by Schwatka, leave no doubt of the error.

The ethnological map is in some respects an advance upon those which have preceded it, although not impregnable to criticism. The spelling of native and Russian names is not according to any uniform system; and the geographical names represent the idiosyncrasies of the author, rather than any standard charts. It is particularly unfortunate that the attempts of the U. S. coast-survey to unify the nomenclature, although already published on some forty or fifty charts, have met with no recognition or co-operation in this report.

The population of the territory, derived partly from estimation and partly from actual count, is 33,425, of which about half are Eskimo. The white population, including creoles, is stated at somewhat over 2,000, which has since been considerably increased in the south-eastern district. A valuable summary of several previous enumerations and estimates shows that there never has been any sound ground for the excessive estimates of 70,000 or 80,000, which are found in most gazetteers. Our space will not permit a detailed review of the various ramifications of the report; but the ethnologist may be particularly cautioned against a too confident reliance on the ethnology of this report as regards the regions not personally inspected by Mr. Petroff, several serious inaccuracies having a place there. The statistics of trade in continental furs since the American purchase are extremely inadequate, owing to the desire of traders to keep their business private, and to the unreported arctic trade; but for this there seems no help. The collection of Russian records of the fur trade by the compiler are particularly valuable, though, as in all such cases, not to be rated as more than reasonable approximations.

The report on the fur-seal fisheries by Mr. Elliott consists of matter several times previously printed, but here revised, and fully illustrated from the author's sketches. It contains by far the best general account of the fur seals of Alaska, together with a quantity of other more or less relevant matters. The estimate of the total number of seals on the islands is, however, evidently much in need of a more exact basis as being the crucial point upon which the regulation of the fishery depends.

Probably no report for the tenth census was

so discouraging to its author as that on the ship-building industry, prepared by Henry Hall, who gives us a detailed history of the rise and fall of this business; and its past prosperity vividly contrasts with the hopeless present and not hopeful future. As a history, the report strikes one as rather stale; but perhaps this was unavoidable, although we might have been spared another repetition of the yarn tracing the origin of 'schooner' from 'How she scoons![1] It is a pity that the illustrations should be so crude and cheap.

In criticism of the whole report, we regret that more details of designing, methods of construction, discussion of steam-boilers, machinery, etc., were not given. The lines of the Boston and Baltimore clippers will interest naval architects.

In beginning with fishing-vessels, the author puts his best foot foremost; for here we can make a pretty fair showing still, at least as far as vessels and capital employed are concerned. As we have always looked upon the fisheries as the nursery of seamen, we wish statistics of the nationality of the crews of the offshore fishermen might have been given, though probably they would not have been encouraging. The rapid concentration of the fishing interests to a few towns of course diminishes the interest of our coast people in marine pursuits. The tables given show that New England has as large tonnage, and as much invested capital, as all the rest of our ocean and lake coasts combined; and Massachusetts represents three-fourths of the whole New-England interest. Attention is properly called to the desirability of giving fishing-schooners more depth and freeboard.

Chapter ii. is a short history of our merchant marine, and is followed by a chapter on the present state of ship-building at every point along the coast, from Maine to Alaska. Almost everywhere the same story: 'Harrington, once a prosperous village,' or, 'There is no ship-building at present at Ellsworth,' and so on. The causes are several, — discouragement of foreign trade by tariff and extortionate consulate fees, local taxation and pilotage laws, interference of railroads with coasting-trade, failure of suitable timber-supply, and the greater cost of iron vessels here as compared with England. Bath, Me., is the principal ship-building port, and it is interesting to see the result of systematic work; for, while timber is from seventy-five to three hundred per cent higher, it is still possible to build a ship at forty-five dollars per ton, as in 1825. On the Pacific coast wooden ship-building is still a growing industry.

[1] The word is probably of Dutch origin, and the rig can be traced back to earlier times than those of Andrew Robinson of Gloucester.

The chapter on iron ship-building offers some hope, in the condition of the more important yards, and the cheapening of the cost of iron vessels. This is fortunate, for the next chapter shows how thoroughly the eastern seaboard has been stripped of ship-timber; and, as well known, second-growth timber is very inferior. The supply of yellow pine, now almost exclusively used for planking, is reported large, but we believe it is growing more difficult to obtain the best quality of this useful wood. The Pacific coast still affords abundance of good ship-timber, and the good character given to yellow fir shows that ship-building on the Pacific need not suffer for years to come. Tables of the specific gravities and weights of the different woods used by ship-builders, by Prof. C. S. Sargent and the late Constructor Pook, U.S.N., are given; and the report is closed with statistics of vessels built in the census year, number of hands employed, wages, value of materials, etc.

MINOR BOOK NOTICES.

The electric light: its history, production, and applications. By ÉM. ALGLAVE and J. BOULARD. Translated from the French by T. O'CONOR SLOANE, E.M., Ph.D. Edited, with notes and additions, by C. M. LUNGREN, C.E. New York, *Appleton*, 1884. 18+458 p. 8°.

THE fascinating character of the subject, and the great popular interest in it, have stimulated the production of pictorial treatises on electricity and its practical applications. To the specialist many of these modern treatises appear to be uncalled for, or at least seem to be padded with much superfluous and unnecessary matter.

Is there not a curious relation between the expensive furnishing of the offices of many electric-light companies, where the unwary person is induced to invest in stock which has only an imaginary value, and the luxurious editions of many treatises on the electric light? If the office should be embellished, why should not the books that treat of the wares of the company be of *éditions de luxe?*

The work of Alglave and Boulard, edited by Mr. Lungren, contains much extraneous matter; but the general reader will find valuable information in regard to the general features of electric lighting. The treatise does not pretend to be an exhaustive presentation of the subject. One is surprised to find how much interesting matter has been crowded into the

volume, notwithstanding so much space is given to large illustrations. Many of the latter are extremely amusing. One of them (p. 85) represents a street in New York lighted by the Brush electric lamps. On the pavement are many mercurial New-Yorkers, waving their hats; and one is so much overcome with enthusiasm, that he turns his back upon the *fait accompli*, and walks away with bared head. Should not this engraving be entitled 'A street in Paris'?

Report on the International exhibition of electricity, held at Paris, August to November, 1881. By DAVID PORTER HEAP, major corps of engineers, U.S.A. Washington, *Government*, 1884. 287 p. 8°.

IT will be interesting to the visitor to the Philadelphia electrical exposition to compare his recollections of that exhibition with Major Heap's report of the Paris exposition of 1881. He will find in this latter work a short and concise account of the principal types of dynamo-machines, and will discover that the new forms which were exhibited at Philadelphia differ only slightly from those described by Major Heap.

The report does not pretend to contain any measurements or calculations, and was necessarily somewhat hastily prepared. The electrician, however, will find it a valuable addition to his library.

A B C de la photographie moderne. Par W. K. BURTON, C.E. Traduit de l'anglais par G. HUBERSON. Paris, *Gauthier-Villars*, 1884. 112 p. 12°.

As its name implies, this work is intended for the beginner in photography, but it contains many hints that those of longer experience might profit by. Beginning with the choice of apparatus, and the arrangement of the dark room, the whole process of photography is described, including both methods of development, to the production of the finished print. The most prominent defect of the work is that the chapters on printing are rather too brief: indeed, there is no description at all of the processes of mounting and burnishing. The chapters on the production of the negative, however, are excellent, as is the one on defects and their remedies.

NOTES AND NEWS.

PROFESSOR Mell, director of the Alabama weather-service, announces, that through the liberality of the chief signal-officer, and of several railways, daily weather-signals, predicting changes of weather and temperature, will be displayed at over one hundred telegraph-stations in that state. The predictions will be received by the director at an early hour every morning from the signal-office in Washington, and then promptly distributed along the railways. By paying for the cost of the signal-flags (about six dollars), any town or telegraph-station will receive free telegraphic warning of the daily weather-changes. Only about five minutes is required to set the flags. A similar system has been for some time in operation in Ohio and in part of Pennsylvania, and it will doubtless have farther extension.

— Herr Warburg has succeeded in electrolyzing glass by heating a piece of soda-lime glass to about 300° C., at which temperature it is a conductor, and placing it between mercury electrodes. It was necessary to use from fifteen to thirty Bunsen cells for a long period. He then found, that, at the anode side of the glass, he had a layer of silicic acid. This layer very quickly reduces the strength of the current, owing to its bad conductivity.

— We learn from *Nature* that a tunnel measuring about five thousand feet in length, and constructed at least nine centuries before the Christian era, has just been discovered by the governor of the Island of Samos. Herodotus mentions this tunnel, which served for providing the old seaport with drinking-water. It is completely preserved, and contains water-tubes of about twenty-five centimetres in diameter, each one provided with a lateral aperture for cleansing-purposes. The tunnel is not quite straight, but bent in the middle: this is hardly to be wondered at, as the ancient engineers did not possess measuring-instruments of such precision as those constructed nowadays.

— Heddebault has succeeded in separating rags of cotton and wool, mixed, by subjecting them to the action of a jet of superheated steam. Under a pressure of five atmospheres, the wool melts, and sinks to the bottom of the receptacle; while cotton, linen, and other vegetable fibres stand, thus remaining suitable for the paper-manufacture. The liquid mud which contains the wool thus precipitated is then desiccated. The residue, which has received the name of azotine, is completely soluble in water, and is valuable on account of its nitrogen. Moreover, its preparation costs nothing; because the increased value of the pulp, free from wool, is sufficient to cover the cost of the process.

— A Berlin correspondent of the *St. James gazette* writes that an engineer named Fisher is reported to have made an important discovery in aeronautics, by which he is enabled to condense or expand the gas in a balloon. The agent he employs is compressed carbonic acid, with the help of which he can ascend or descend at pleasure. This perpendicular movement puts it in the power of the aeronaut to go up or down until he finds a current of air moving in the horizontal direction he wishes. Military critics attribute great importance to this discovery, because in time of

war a balloon will be able to reach the enemy's territory, and ascend again, without requiring a fresh supply of gas.

— Weill, who has spent many years on his experiments, has, it is said, at last succeeded in coating instantaneously all the ordinary metals and their alloys with a thin film of brass, which can be varied in color. He uses only a single battery-cell, and obtains at will solid deposits of various hues and brilliancy. The tints are stated to be due to the formation of copper oxides, the composition of which has not yet been determined.

— *Nature* states that the *Globus* reports the discovery of the ruins of an ancient city near Samarkand. They are situated upon a hill which was doubtless a fortress formerly. Remains of utensils and human bones have also been found. According to Arabian sources, the large city of Aphrosiab existed there in the time of Moses: it was the royal residence; and the king's castle stood on the hill, and was provided with subterranean corridors. The result of the excavations shows that the ruins are indeed those of a very ancient city. The various depths, however, differ widely. In the lower ones fine glass objects are found, which are quite absent from the upper ones. The lowest layers contain remains of a very primitive nature, i.e., coarse implements of clay and flint. The excavations are being continued. News from Turkestan announces the discovery of another ancient city. Achsy, on the right bank of the Amu Darya. Remains of brick walls and other buildings are said to be visible in considerable numbers.

— The December number of the monthly meteorological charts of the North Atlantic, described in *Science*, iii. 654, was recently issued by the Hydrographic office, completing the set. It is announced that work in a similar direction has been begun for the South Atlantic.

The November number of the North Atlantic pilot chart is also just published. The bark Ethel Blanche continues its zigzag way across the ocean, being now reported for the sixth time. Two storm-tracks are charted, one of tropical origin, noteworthy in not advancing west of longitude 58° west, before turning to the north-east: the other storm seems to have left our shores near Charleston, and then spent four days in turning round a sharp loop, and recrossing its path, before finally moving away to the north-east.

— After thirty-three years of duty, Gen. Isaac F. Quimby has been compelled by ill health to retire from the professorship of mathematics and natural philosophy at the University of Rochester.

— Ensign J. J. Blandin, U.S.N., has been ordered by the navy department to the Johns Hopkins university, for a course of study in physics and chemistry.

— L. R. Hammersly & Co. of Philadelphia announce a work on Indian sign-language, by the late Capt. W. P. Clark, U.S.A.; and E. & F. N. Spon announce a practical treatise on the manufacture of bricks, tiles, terra-cotta, etc., by Charles Thomas Davis; also a new book by I. Lothian Bell, entitled 'Principles of the manufacture of iron and steel, with some notes on the economic condition of their production.'

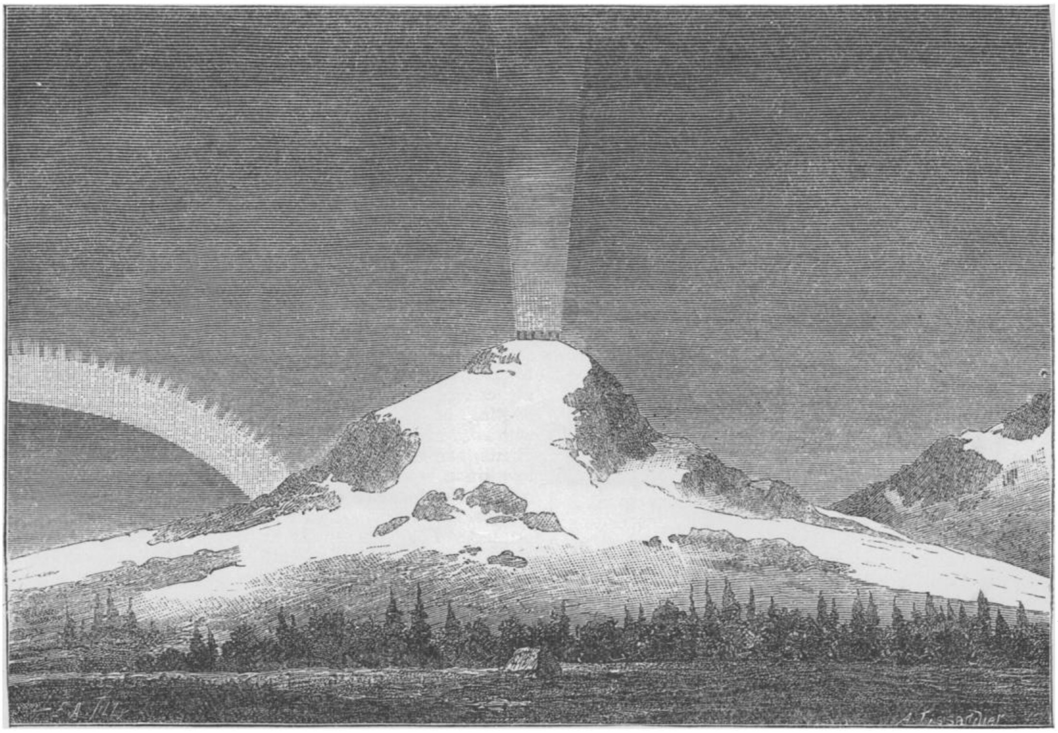
— Capt. Kostovich of the Russian navy proposes the use of a small captive balloon, to which an Edison lamp is suspended, for night signalling. By the aid of connecting-wires, the lamp may be lighted and extinguished at will, and the apparatus may thus be used with any of the codes in vogue.

— The report on the prizes offered by the Berlin royal academy of sciences was read at the July meeting. The Steiner prize for geometry was not granted, as no essay reached the required standard of excellence: the grant was therefore postponed until March 1, 1886, when it will be offered for the best geometrical treatise written in German, Latin, or French. One prize has, however, been accorded to Professor Fiedles of the Zurich polytechnic school, for his work in geometry. The subject for the Cothenius prize is, "By personal experiment and chemical research to ascertain the assimilation process of plants in light, and by direct proof show in the plant-fibres the primary assimilation products of the carbon in plants, distinguishing them from the similar products of transformation in the change of matter in the cells, and showing its chemical nature." As some approximate solution of the problem, a clear demonstration will be accepted of the present ideas on the assimilation process of plants, and the primary organic generations thereof by repetition of the series of observations and researches already made, and an important extension or limitation thereof. The Diez prize of the academy, of two thousand marks, has been granted to Professor Pio Rajna of Florence, for his work on the origin of the French epic.

— It is reported, says the *Engineer*, that the attention of the Indian government has been drawn to a tree in southern India, from which large supplies of caoutchouc can be drawn. This is the 'Teichmig' of the Chinese, or Prameria glandulifera of botanists. Unlike the South-American tree, from which the caoutchouc is tapped by piercing the bark, the gum is obtained from the new source by breaking the boughs, and drawing it out in filaments. If the new caoutchouc is at all equal to the old in insulating-properties, it will form a timely discovery; for the introduction of electric lighting has created an increased demand for india-rubber coated wires. Indeed, several inventors have lately been engaged in trying to manufacture a substitute for gutta-percha and india-rubber out of oxidized oils; that is to say, oils treated with chloride of sulphur, mixed with asphalt, ozokerit, and other insulating substances.

— The effect produced by Mr. Selim Lemström in his experiments on the artificial production of the aurora is well shown in the illustration on the next page, from a drawing by Mr. Lemström. On the top of the mountain a wire was stretched on poles, and furnished at every foot or two with brass points. This wire was several miles in length, and was carried over the top of the hill in the form of a spiral.

The poles were supplied with sulphuric-acid insulators in order to prevent, as far as possible, the creeping of electricity over their surfaces. From this insulated system of points a wire was run to a ground-connection at a lower level, perhaps from five hundred to a thousand feet below. If the ground-connection had been made on the same level, no current would have been observed; but when there was a difference of level, even if not more than thirty feet, a current was always observed from the higher point to the lower. The luminous effects portrayed in the cut were only visible to the naked eye when there was a marked display of northern lights; although by the aid of the spectroscope, which would show the peculiar spectrum of auroral light, the existence of the streamer could often be proved.



A VERTICAL SHEAF OF LIGHT OBSERVED, DURING A DISPLAY OF THE NORTHERN LIGHTS, ABOVE A SYSTEM OF WIRES ON THE TOP OF PIETARINTUNTURI, NEAR KULTALA, FINNISH LAPLAND. (Reproduced from *La Nature*.)

— Balbiani, professor at the Collége de France, was commissioned a short time ago, by the minister of agriculture, to report upon the best mode of destroying the winter eggs of the Phylloxera, as it has been found that it is in this way the progress of the parasite is very materially checked. Professor Balbiani reports that three methods have been employed, — the mechanical destruction of the eggs by barking the vines, boiling water, and rubbing the vines with preparations calculated to burn up the eggs. The first-named of these methods has been tried in several vineyards near Bordeaux, the workmen rubbing the stocks with a chain-steel glove; but the results are not satisfactory, as it is only the old wood which can be treated in this way. The use of boiling water would produce excellent results but for the fact that it is open, more than any other process, to carelessness in application; and that neutralizes all its good effects. The rubbing of the vines with a preparation composed of nine parts of coal-tar to one of oil was open to the objection that the coal-tar got so thick in cold weather that it could not be applied, and the cost of heating it again was considerable. Several vine-growers tried to liquefy the mixture by adding fifteen per cent of turpentine; but this, when applied, killed the vines altogether. Balbiani tried several fresh experiments, among others a mixture of oil, naphtha, quicklime, and water. This mixture has been tried upon a very large scale in the vineyards of the Lot-et-Garonne and the Loir-et-Cher; and it possesses, according to Balbiani, the double recommendation of being effectual and cheap, as the cost is under a franc for a hundred stocks.

— A Washington correspondent informs us that it was the Mohave and not the Zuñi women whom Dr. Tylor mentioned, at a recent meeting of the anthropological society of Washington (see *Science*, p. 448), as wearing bark skirts.